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CARIES OF THE SPINE, ANGULAR CURVATURE
OR POTT'S DISEASE.

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GENTLEMEN:—The disease which I have to discuss to-day is called "Pott's Disease" because it was first accurately described by Percival Pott of St. Bartholemew's Hospital, in 1779.

My first illustration is an adult, whom I have selected because she is not nervous and will lie quietly without making any disturbance. In her, you see a fairly good example of Pott's disease of the lower dorsal region, involving the last dorsal and the first two lumbar vertebræ. These three vertebræ stand out quite prominently, particularly the middle one. This is a good example of angular curvature.

The *age* at which Pott's disease is found is, usually, up to the tenth year,—you may find from the third to the tenth;—a few cases have been seen earlier than that. Mr. Howard Marsh has reported a case at the tenth month, and other cases at a year and under. On the other hand, you find illustrations of Pott's disease at the opposite extreme of life, and cases are reported at sixty, sixty-one, and sixty-four years. It is well to bear in mind the occurrence of the disease at the extremes in age, in order that the symptoms may not be allowed to pass unrecognised when appearing in infants or old people. The great majority of cases, however, occur from the third to the tenth year.

In the matter of *sex*, in this period of life the sexes are about equally represented. You know that boys and girls, up to about ten years of age, enjoy about the same amusements, romp and play, climb fences, and get tumbles, about equally; and there is not much difference in the frequency of the disease in the two sexes at that time of life.

With regard to the *etiology* of the disease. Pott's disease is always tubercular. There are, however, other pathological processes occurring in the vertebræ. Angular curvature may be due to traumatism alone, or there may be curvature due to osteitis, and softening from pathogenic organisms, not tubercular. These cases are generally rapidly cured.

Then again, it may be due to syphilis, either hereditary or acquired. This disease is more frequently observed in the upper cervical region, is rapid, occurs later in life than tuberculosis, and is more easily cured. And lastly, it may be due to malignant disease of the bones of the spine. These possible conditions should be remembered as checks to help in a correct diagnosis. When we speak, however, of Pott's disease or angular curvature, we always mean tuberculous disease of the spine.

In the majority of cases the disease is located in the dorsal region. Parker gives the following figures:—cervical, 9; dorsal, 82; dorso-lumbar, 21; lumbar or lumbo-sacral, 37; out of 149 cases.

The part of the vertebra first attacked is, as a rule, the anterior part of the body. In children, each vertebra has an epiphyseal plate on its upper and lower surface, and in many cases the disease begins as a juxta-epiphysitis. So far as I know, there are no cases reported as occurring in the articular processes, these are very firm and hard, but occasionally the spinous processes are involved. Then, the disease may begin near the posterior surface of the body, and the extrusion of bone may press backwards on the membranes of the cord. A statement is sometimes found in the text-books that the disease may begin in the inter-vertebral substance. Close observers, writing with considerable experience in the autopsy room and with large museums to inspect, say, that it must be considered very doubtful if the disease ever does begin in the inter-vertebral substance.

The *course of the disease* varies a good deal with the circumstances of the case and the resisting power of the patient. It may go on to form a tubercular osteitis with more or less breaking down of the bone and absorption of the inflammatory material as fast as it is produced; a variety known as *caries sicca* and ending without the formation of an abscess. The same thing occurs in the hip joint and knee joint. In this variety, too, there is sometimes more than the usual amount of pain.

In a considerable percentage of cases the formation of large or small *abscesses* occurs, their size and future course depending upon the amount of the disease, the resisting power of the patient, and the treatment adopted. The direction taken by an abscess arising from caries of the vertebrae is determined by the contiguous fasciae. In the neck, for instance, the cervical fascia passes from the spinous processes, investing the trapezius, to the posterior border of the sterno-mastoid muscle where it splits and unites again in front. A cervical abscess may get in front of this fascia and pass into the mediastinum or form a post-pharyngeal abscess. In the dorsal region, an abscess may pass into the pleura, occasionally perforate the lungs, or pass between the posterior ends of the ribs and between the transverse processes, and, following up the posterior branches of the intercostal arteries, appear on the back. In the lower

dorsal region the abscess, instead of passing back between the ribs, occasionally goes down the spinal column, and passes beneath the ligamentum arcuatum internum into the psoas sheath. Occasionally, it passes down behind the anterior common ligament and pierces the diaphragm. In the lumbar region, the abscess may pass down right on the bone, and then down behind the vessels and beneath the iliac fascia and form an iliac abscess; or, it may pass into the pelvis and appear at the sciatic notch. The sheath of the psoas is attached to the vertebræ internally, and in front is continuous with the ligamentum arcuatum internum above and the iliac fascia below, and behind is continuous with the anterior lamella of the lumbar fascia. The lumbar fascia consists of three layers, the posterior arising from the spinous processes and the two anterior layers from the transverse processes. The quadratus lumborum lies between the anterior two layers. The middle layer gives origin to the internal oblique and transversalis muscles. The anterior layer is very thin and is frequently perforated by abscess. Again, behind the posterior border of the external oblique is a weak point called the triangle of Petit, bounded in front by the posterior border of the external oblique and below by the crest of the ilium. A lumbar abscess sometimes points in this situation.

Now, the *symptoms and diagnosis* of this condition are the next points to be considered. The result of spinal caries is deformity, and deformity is sometimes the first thing you are consulted for by the parents. It is well shown here in this case before you, but in every case it may not be so easily recognised at first. The deformity depends on the collapse of the bodies of the vertebræ which are diseased and soft and give way beneath the weight of the head and shoulders. When the deformity occurs high up there may be a displacement of the viscera, from the alteration in the shape of the cavities, due to the bending of the spinal column. If it is in the dorsal region, the chest may be encroached upon, the lungs depressed, and the abdominal viscera pushed down. Sometimes the head is thrown back, the back is raised, and the apex of the heart is found in the third space.

The next symptom we have to deal with is compression paraplegia. You might think at first that this compression paraplegia would be due to bone pressure on the cord. That, however, is not often the case; the paraplegia is as a rule due to granulation tissue and pachymeningitis. The disease extends back from the body of the vertebra into the vertebral canal, granulation tissue forming and being pushed back through, and pachymeningitis develops. Occasionally the disease may extend through the thickness of the bodies and the granulation tissue be pushed back when they begin to collapse from the superincumbent weight. On

he other hand, the tubercular disease may soften the bones and enlarge the vertebral canal and that is why we do not have paraplegia occurring more often ; under these circumstances there is more space for the cord than normally exists.

We may also have an abscess or a spicule of bone or sequestrum pressing back against the cord ; and occasionally the pressure may be due to hæmorrhage. In the latter two alternatives the onset of the paralysis would be sudden, as a rule, however, it is due to granulation tissue, and the onset is gradual. Compression paraplegia is generally complete and bilateral. In one case, which is pretty well cured now and which I will show you, there is still paresis. In a man discharged recently there was a complete paraplegia both motor and sensory; yet he is cured of the paraplegia and is pretty well and went off the other day in very good form. In compression paraplegia the muscles generally waste. The reflexes in the earliest stages are sometimes greatly increased, but when the paraplegia becomes complete, the reflexes, both superficial and deep, are abolished. The circulation is poor and often the limbs are cold and the skin is covered with a profuse sweat. In syphilitic disease and cancer of the spine, or in the case of a spicule of bone as the cause of compression, one side only may be involved.

These cases occur particularly in children and very infrequently do we have an opportunity of making a diagnosis at the very earliest stage. Too often, when the child is brought to us, the diagnosis is only too easily made. The earlier symptoms should be borne in mind and each case should be examined thoroughly. The first thing that the mother will say, as a rule, is that the child is easily tired, and perhaps is awkward. The child trips and stumbles about and is not active on its feet, is easily tired and irritable and sometimes may complain of pain. In cervical disease, we occasionally have neuralgic pain extending up the back of the head, pain which is referred to the region of the sternum, or pain simulating an intercostal neuralgia. In dorsal, there will occur colic and, perhaps, signs of gastric crisis, or the pain will run down the legs, involving the nerves of the lumbar or sacral plexus.

When these symptoms and the feeling of being easily tired are present, you should strip the child and examine it thoroughly and methodically, as in a case of hip disease. You should put a skirt upon the hips so that you can get the whole body and chest exposed for examination. In the first place make a thoroughly careful inspection. See if the spines of the vertebræ are all straight in line and if any one of the vertebræ stands out more prominently than it should, remembering the normal prominent spire. Put your hand on the spine. In bending, it yields regularly and evenly and equally, beneath the hand ; then, when the

child straightens, the bones come gradually and proportionately into place. A good way is to ask the child to pick up something. (The only child I could use for this purpose to-day is so fretful I cannot bring it in.) If you drop a cent on the floor the child that has spinal disease will bend first the hip and then the knees, in reaching for it, and then get up again in the same way. This is characteristic of what Sayer used to call a muscular splint already applied to the diseased spine. This rigidity can also be demonstrated by taking the child across one's knees and letting the head fall one way and the legs the other. By approaching the knees and thereby increasing the deformity there may be, in severe cases, apparent difficulty in breathing, and pain, both being relieved by separating the knees and straightening the child's back.

Next, examine for irregularities and tender points. Often you will get a history of traumatism in these cases combined with the tubercular disease. Rickets should not give much trouble in diagnosis. Rickets does not cause angular curvature but more of an arch, which straightens out when you lift the child up, while the other is permanent. This simple test is generally enough to enable you to eliminate rickets.

The hysterical spine in young ladies is sometimes troublesome and you have to be a little guarded in your opinion. I think Paget's description of it is unsurpassed. In the first place, there may be, and very often are, several tender points instead of one. Secondly, the pain is exaggerated. Thirdly, if you only touch the skin the patient will complain more loudly than if you put your hand firmly upon it. This is a pretty good test. Then, again, if you distract the patient's attention you can press quite hard, unless she happens to remember what you are doing, without causing much pain. The absence of deformity will help you. The patient will bend her back and turn over, which she could not do if she had tubercular disease. With attention to these points you will generally be able to diagnose correctly.

What is the the *prognosis*, in the first place as to life, and in the second place as to deformity? Now, in making a prognosis bring all your wisdom into play. You cannot learn a rule of prognosis the way you learn a rule in arithmetic. You have to consider, first and foremost perhaps, the situation of the disease, its extent, the number of vertebræ involved, and the length of time the disease has been going on. Then, take into serious consideration the personnel of your patient. We have always two forces at work, the enemy, which is the disease due to a bacillus: and we have the patient,—we have the resisting recuperative power to meet that attacking germ. And in estimating that you have to consider the family history and the social condition. I suppose in very considerably over half the cases, 68 per cent., it is estimated at, there is a family history of tuberculosis. If it is a strong history it will make

you form a graver prognosis than if there was no tuberculous disease in the family. Then, if the patient is in a condition to procure fresh air, careful nursing, and braces and jackets when required, the prognosis will be very much better than if the patient, from poverty and the carelessness and indifference of parents, is not likely to get proper care. As a rule, with a fairly good family history and the means and disposition to get good treatment, the prognosis is very good for life; and, with careful treatment, I think it is very good as regards the deformity. Sometimes the deformity can be somewhat lessened only; but, if you are careful and circumstances are fairly well on your side, you can prevent the increase of the deformity to any great extent. (This patient required treatment for a good while.) How long it will take, you cannot say, but you are generally safe in assuming about three years; sometimes a little shorter and sometimes a good deal longer, depending on the complications and other circumstances.

The *cause of death* in these cases varies. It may be suppuration, abscess, infective abscess leading on to septicæmia and pyæmia; or lardaceous disease of the liver and kidneys. Very often it is general tuberculosis, tuberculosis of serous membranes, or tuberculous meningitis. The resisting powers being lowered, the patients frequently succumb to a pneumonia or other intercurrent disease.

With regard to the *treatment* of which there is a good deal of difference of opinion and a great many different methods. I will tell you what I think about the treatment of these cases. In the first place, of course, I will assume that you put these patients under the best hygienic surroundings possible, and that you give them the most nutritious and suitable diet. If you can, give them mountain or sea air, etc. I am very strongly in favour of the recumbent position in the early stage of both spinal disease and hip disease, and every year, although I have sometimes tried to get on the other side, I find myself more and more confirmed in this idea. The success attainable by treatment with apparatus will depend a great deal on where the disease is situated. Often, it is situated low down, and here, perhaps, you can do more in the way of holding the patient up with apparatus; but I say, with all due deference to other people's opinion, that I am not yet convinced that it is possible to apply an apparatus which will carry the upper part of the body and relieve it from pressing on the diseased area. And that is where the mistake is made, that is, that even the best apparatus only brings the weight back on to the lateral masses. I will bring a child in here to whom a plaster jacket was applied two or three days ago. Many of you here saw it put on. Now, you can put your hand inside that jacket, and it is evident that it does not carry the patient's weight, it only keeps it from coming forward. One cannot carry patients in this manner. One cannot

put crutches under their arms that will carry them without excoriation and pain. In the cervical region one cannot put on a harness that will hold the head up. Apparatus will prevent the vertebrae from collapsing and coming forward, and in that way throw the weight on the lateral masses which are very seldom affected by tubercular disease. That point is being brought out more and more every year. Noble Smith has written a book to expound that very principle and has figured what he calls his splint for pressing forward the back, holding back the shoulders, and throwing the weight on the lateral masses; and I think it is a very important point in the treatment.

I believe, in the early stages, in putting the patient in bed. By so doing perfect rest is obtained and the best means afforded of preventing the increase of the deformity and limiting the extent of the disease. If you can get a bright sunshiny room you can put a child in bed for nine months or a year, and it will get fatter and fatter every day. You can take the child out on the lawn in summer and under the trees, and give him all the change necessary. Rest in bed alone is not sufficient, as it permits turning about and twisting. A fixation apparatus is required in addition; a Thomas' splint, or one of these frames of gas-tubing filled in with canvas, answers very well. Extension may be applied, if required, to either the head or the legs or to both. The child is placed on the frame with a band over the chest and one over the pelvis. It can then be moved from one room to another or carried out to the lawn without disturbing the position. Or, the child may be put in a plaster jacket, head, shoulders, body, and both limbs. Keep them quiet by one or other of these means for eight or nine months, or until the disease has ceased to be progressive and the pain is gone. Then, when the diseased spine seems to be more fixed, less pliable, and less movable, begin to take more liberty, and finally adopt the ambulatory treatment. This consists in the application of plaster in the manner you saw the other day; the man has now left the hospital. A very nice easy way of applying plaster to children is by stretching them out on a hammock in the horizontal position as was done in this case. (Child shown.) A better way still is to take a plaster cast like this one, remove it and send it to the instrument maker. He will make a mould from the cast and over that mould will fit one of these jackets. (Shown). This one is made of paper and, I understand, is patented. It is very light, and Mr. Chapman tells me, only weighs 14 ounces. Or, it may be made of leather and then will weigh a little more. The great objection to these is their expense, the leather ones costing \$35.00, a sum of small moment to some people but beyond the reach of the majority of our patients.

Dr. Hadra, of Chicago, has recently advocated immobilization of the vertebrae by wiring the spinous processes together. He cuts down and

exposes the processes and wires from two or three above to two or three below the point of disease. He described his method in a paper read before the American Orthopedic Association and published in their last annual volume, but, in the discussion which followed, serious objections were raised against it. In the first place, a considerable wound is made, and in the second place, the wire would probably cause erosion and possibly necrosis.

The latest method of treatment is that, introduced by Calot, of immediate forcible straightening. You are all familiar with it I suppose. Dr. Wilson has been carrying it out here in a considerable number of cases, generally under ether. Parker, and Goldthwaite of Boston, have done it without ether. The straightening should be preceded by a pretty thorough purgation to facilitate the manipulation by the hand placed on the abdomen. With one hand placed over the spine behind and the other in front the curvature is straightened by pressure. After straightening the part, one at once immobilizes with plaster of Paris. This may be done in many cases without ether, and of course, very easily under ether. The method is very new and also very old. Hippocrates, writing 500 years before Christ, describes the same treatment carried out in a rough manner by letting the patient drop, from a ladder. He wrote that he did not think much of it himself and never practised it. Enough cases have been done in France, England, the United States, and here in our own clinic, to satisfy every one, I think, that it can be done with impunity. No harm comes from it; these children do not get meningitis, they do not get abscess, they do not get general tuberculosis, they do not get hæmorrhage, or fever, or paralysis. Paralysis, if present, is relieved by the operation, and the parents are delighted with it. It is, at first, thoroughly satisfactory, of course in selected cases. I do not think it would be advisable to attempt Calot's method in these cases, because the curvature is considerable, several vertebræ are involved, and the gap left would be too great and probably never fill in. The whole question is how to fill up the gap. Tubercular disease of bone is very slowly repaired, but a little more rapidly in the vertebræ than in other joints. Here, I can get rid of the lump and deformity by rapidly straightening it out and it will be just the same to-morrow as to-day, but I should create a gap and how to fill this in and secure bony ankylosis is the whole problem. I think years must elapse before we can pronounce finally on this very radical method and learn what cases are suitable for it. Let us hope, for the sake of the patients and ourselves that the results will justify the advocacy of the treatment. In case, however, you should be too enthusiastic about it, I will simply refer to two autopsies reported by Mr. Murray, of Liverpool. The first was a boy four years of age who was brought to him with disease in the lower dorsal region of three

years standing. There was no abscess and no paralysis. He straightened the disease under ether. In ten days the child went home seemingly in first rate condition. Two months later he died from pneumonia, and at the autopsy there was no evidence of repair,—in fact there seemed to be a sort of false joint formed at the point of the disease. The pneumonia was not thought to be due in any way to the straightening of the diseased spine. The second case was a girl three and a-half years of age, who had had the disease for two years in the upper dorsal region. Mr. Murray straightened it and the child went home in ten days in good condition. It died three months later of meningitis and general tuberculosis. The family history was not good, and Mr. Murray does not think that the operation contributed to the general tuberculosis or meningitis. But, at the autopsy, there was no evidence of repair and the spine was freely movable, not firm nor fixed. That, perhaps, was not a good example and not a good patient, but I think, in putting the subject before you, that it is only right to present both good and bad results and to show that it is not yet proven that the gap is filled in. Calot's treatment, however, may be found to be followed by satisfactory results when applied early, before there is much deformity, but time alone will demonstrate how far this procedure will contribute to a more successful issue in this form of tubercular disease. I have dwelt so fully on previous occasions, upon the treatment of abscess in Pott's disease, that I need not discuss that question again to-day.

